

GWK STRUCTURAL SOLUTIONS LTD **CONSULTING ENGINEERS**

Proposed Drainage Strategy to Discharge Planning
Conditions 19,20,21 &22 of Application Ref:SMD/2022/0532

PROJECT REFERENCE:

- **Project No:** GK4270
- **Project Location:** Land East Of Sugar Street Rushton Spencer
Staffordshire
- **Project Title:** Sugar Street
- **Client:** Rider Enterprises

				APPROVALS	
Issue	Date	Pages	Issue Description	By	Check
A	20/03/24		Issued to discharge planning condition	PG	GWK
☒ Entire Report Issued this Revision		Report Issued for:			
☐ Revised Pages Only Issued this Revision		☐ In-house Review	☐ Purchase		
		☐ Client Approval	☐ Construction		
		☐ Inquiry	☒ Planning		



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1.0 Introduction

1.1 Summary

In 2021 an outline planning application was submitted to Staffordshire Moorlands District Council for erection of 4 dwellings made up of mews style properties with the associated infrastructure.

Planning approval was granted (ref: SMD/2021/0784) in 2021 with a subsequent application for minor layout changes in December 2022.

This report has been prepared to discharge the drainage related planning conditions; Numbers 19, 20, 21 & 22.



2.0 Drainage Strategy

2.1 Existing Drainage

The Severn Trent Water sewer records have been reviewed and indicate no adopted sewers in close proximity to the site.

The site is currently undeveloped, and no positive drainage has been identified.

2.2 Hydrology

An unnamed watercourse that commences from the outfall of a 150mm diameter culvert was located on higher ground to the east of the site. This flows south westerly around the adjacent residential property and then into an open channel on the northern side of Leek Old Road. The flows then pass into a culvert and head south beneath Leek Old Road, the garden of a residential property, the A523 highway and the Canal & River Trust Feeder Channel, where it then outfalls to Rushton Brook, a further 60m downstream.

2.3 Highway Drainage

At the lower end of Sugar Street a number of highway gullies were located. Investigations carried out on site identified that these merge with the gullies from Leek Old Road and outfall to the culvert identified above and which ultimately outfalls to Rushton Brook.

Discussions with Staffordshire CC Highways have confirmed that connection to the highway drainage network would not be possible.

2.4 Existing Geology

A Phase 2 ground investigation has been completed at the site. This identified made ground over soft sandy silty clay to depth. BRE 365 soakaway tests were undertaken with no results determined due to the clay.



2.5 Sustainable Drainage

Sustainable Drainage Systems (SuDS) are utilised in line with the CIRIA 753 guidance with the aim to minimise the development's impact on the runoff quantity and quality and maximise amenity and biodiversity opportunities.

The management train approach is a fundamental principle of SuDS systems, it aims to primarily reduce pollution, flow rates and volume of runoff from the site. The main objective is to treat the runoff as close to the source as possible and where possible for at least two of the following should be included within the drainage strategy.

- **Prevention** – The use of good site design and rainwater re-use measures to prevent runoff.
- **Source Control** – Controlling the runoff as close to source as possible by using green roofs, porous pavements and soakaways.
- **Site Control** – Use of water management techniques within local area, i.e., detention basins and geocellular storage.
- **Regional Control** – Management of water from a number of sites in a specific location, i.e., balancing ponds and wetlands.

The drainage strategy for this development will incorporate prevention measures in the form of water butts and site control methods in the form of a geocellular tank upstream of a pumping chamber controlling the peak flows.

2.6 SuDS Hierarchal Approach

Based on the existing drainage configuration, plus an assessment of the local site conditions, the SuDS hierarchal approach for discharge of surface water at the development site is considered in detail below:

Method	Suitability	Suitability for Development
Infiltration to Ground	No	Investigations have identified the underlying ground to be cohesive and thus not suitable for infiltration-based options.
Connection to Watercourse	Yes	New pumped connection to the watercourse located on higher ground to the east of the site.
Connection to Surface Water Sewer	No	No surface water sewer in close proximity
Connection to Combined Water Sewer	No	No combined sewer in close proximity.

Figure 1: SuDS Hierarchal Approach

2.7 Surface Water Drainage Strategy

The general principal of the surface water drainage strategy is to collect the runoff from the roof of the new residential properties and direct it to a number of RWPs that will drop down via water butts to a new below ground surface water drainage network. The network will merge with the runoff from the access road before passing into a below ground geocellular tank. The outflow from the tank will be restricted to 4.0l/s via a new surface water pumping chamber that will direct the flows to the open watercourse.

Full details of this strategy can be found on the GWK Drainage GA drawing in Appendix A and the hydraulic calculations in Appendix B.



2.8 Foul Water Drainage Strategy

The general principle of the foul water drainage strategy is to collect the runoff from each of the properties and direct it to a new below ground foul water drainage network. The network will flow north where due to the higher level a pump chamber will lift the network that then passes through a new suitably sized sewage treatment plant. The treated flows will then be pumped up to the open watercourse on higher ground to the east.

2.9 Water Quality

Water quality has been considered and the following measures have been included within the surface water drainage proposals:

- Runoff from roofs is generally considered to be clean and will be discharged directly into the surface water network.
- All drainage from the small access road is considered to be low and will pass through the trapped gullies.

2.10 Maintenance

The drainage network encompasses standard pipework and manholes, geocellular tank and flow control. As long as the gullies at the base of the rainwater pipes are kept clear of leaves and detritus by regular inspection by the property owners then this should negate it passing into the network.

All management and maintenance of the drainage within each of the units and access road will be with the property owners to maintain the gullies, manholes, flows controls and attenuation tank. This will involve general maintenance of the drainage network in accordance with best practice, which is covered in Ciria guidance C753. Annual inspections will need to be carried out and clearing of gullies, channel drains and catchpits constructed.

Typically, the maintenance regime will be in line with the table below.

Future Maintenance of the Drainage System			
Responsibility	Feature	Maintenance	Frequency
Property Owners and Management Company	Rainwater gutters, downpipes and above ground drainage.	Regular maintenance and inspections.	Ad-hoc sweeping and emptying of silt and debris required. Annual visual inspections to check for damage/leaks.
	Pumping Chamber	Regular maintenance / removal of blockages and debris.	Annual inspection and following significant rainfall events.
	Geocellular tank	Regular maintenance / removal of excess grasses and debris to prevent entering tank.	Annual inspection and following significant rainfall events.
	Pipes, sewers, manholes	Regular maintenance / removal of blockages and debris.	Annual inspection and removal of silts if required.

Figure 2: Outline Management & Maintenance Plan



3.0 Drainage Related Planning Condition and Responses

3.1 Planning Conditions

Detailed below are the drainage conditions Numbers 19, 20, 21 & 22 are in italics with the GWK response in Blue beneath each point.

Condition 19

Development shall not commence until specific details of the foul water drainage scheme have been submitted to and approved in writing by the local planning authority. The scheme shall be implemented as approved and completed prior to the development being brought into use.

Refer to the Drainage GA drawing in Appendix A which defines the proposed foul water drainage network.

Condition 20

Development shall not commence until specific details of the disposal of surface water has been submitted to, and approved in writing by, the local planning authority. The scheme shall be implemented as approved.

As described in the earlier sections, the SuDS hierarchal approach has been considered for the draining of surface water from the development site. The underlying ground comprises clay and thus not suitable for infiltration. As such a new pumped connection is to be made to the local watercourse at a rate of 4l/s.

Condition 21

The water run-off from the proposed gravel surface of the shared car parking area and the permeable paving shall be treated before discharge in accordance with details to be submitted to and approved in writing by the local planning authority before the development is first brought into use.

No permeable paving is now proposed and so the risk to the underlying ground is removed.

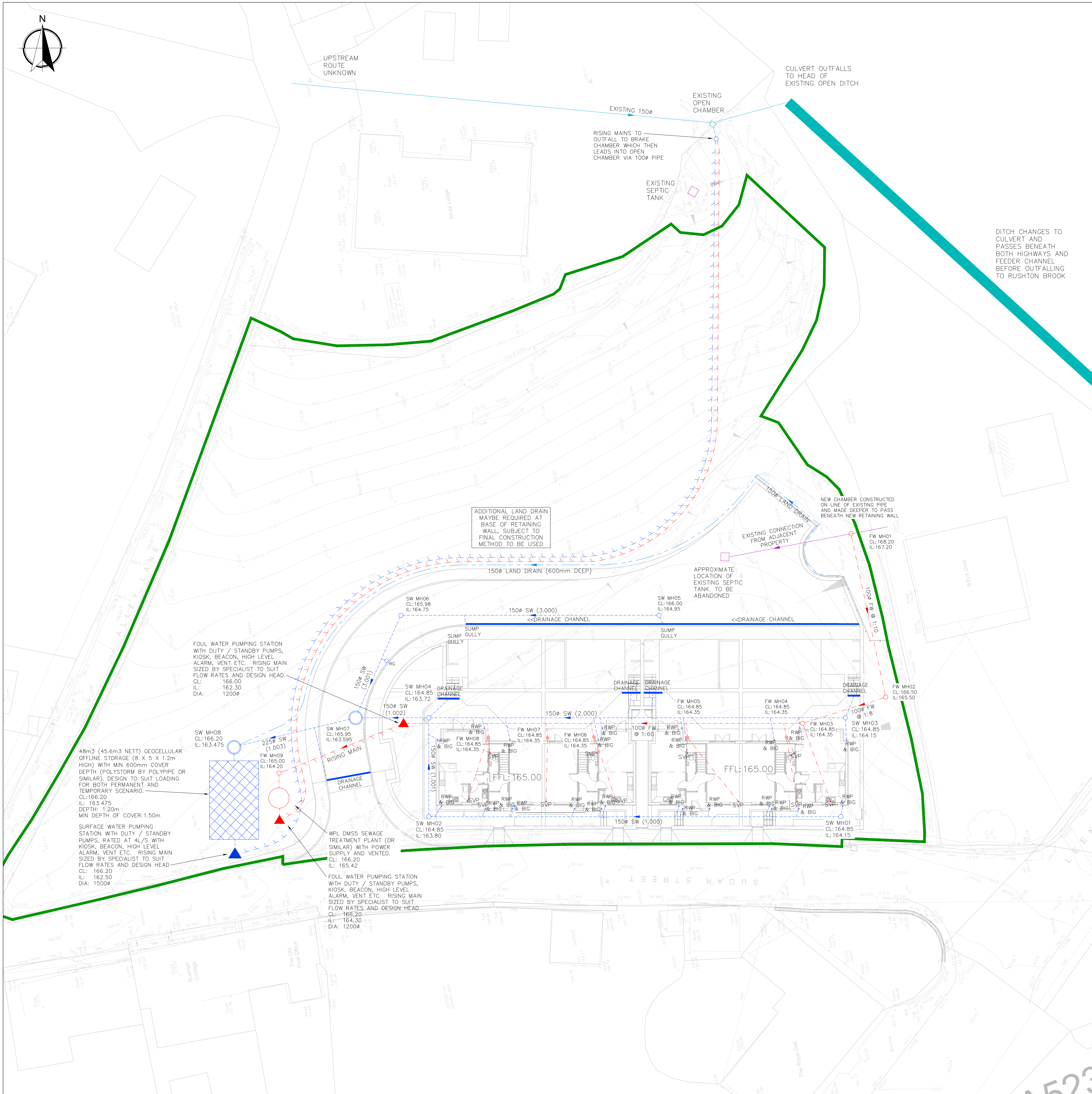
Condition 22

Before the commencement of works, details of the existing off-site private wastewater system discharging onto the site adjacent to Sugar Lane shall be submitted to the local planning authority and any measures or works in response to the details as agreed in writing by the local planning authority shall be undertaken before the development is brought into use. The details shall include the following:

- If the drainage is a wastewater overflow or treated effluent;*
- Whether or not the flow drains to ground on-site or enters surface water courses, via road drainage;*
- Evidence to demonstrate the flow does not pose an additional contamination risk to the development site;*
- An assessment of the potential contamination risk to groundwater at depth.*

An existing septic tank has been identified in the centre of the site serving the property to the south. The outflow is to a drainage field. The tank and drainage field are to be completely removed with the flows from this property directed into the proposed foul water drainage network serving the new properties and passing through a new sewage treatment plant.

Appendix A - GWK Design Drawings



1. THE CONTRACTOR IS RESPONSIBLE FOR THE CONFIRMATION OF ALL POSITIONS AND LEVELS OF EXISTING DRAINS, SEWERS AND MANHOLES PRIOR TO THE COMMENCEMENT OF THE PROPOSED WORKS AND ANY DISCREPANCIES REPORTED IMMEDIATELY TO GWK.
2. ALL PRIVATE DRAINAGE WITHIN THE SITE IS TO COMPLY WITH THE REQUIREMENTS OF BS EN 752 AND BUILDING REGULATIONS PART H.
3. NO DEVIATION FROM THE CONTENT OF THIS DRAWING IS ALLOWED WITHOUT PERMISSION OF GWK.
4. FOR DETAILS OF WORKMANSHIP AND MATERIALS REFER TO THE SPECIFICATION, BUILDING REGULATIONS AND BRITISH STANDARDS CURRENT AT THE TIME OF THE WORK.
5. ADEQUATE PROTECTION IS TO BE PROVIDED TO MAINTAIN INTEGRITY OF THE EXISTING SERVICES AND PROPOSED WORKS DURING CONSTRUCTION.
6. COVER LEVELS ARE PROVISIONAL AND THE FINAL LEVEL SHOULD BE ADJUSTED AND SET TO SUIT THE PROPOSED FINISHED LEVELS AS CONFIRMED BY THE ARCHITECT.
7. CONCRETE SURROUND IS TO BE PROVIDED TO ALL DRAINS WITH A COVER OF LESS THAN 1.2m OF THE FINISHED GROUND LEVEL IN HIGHWAY AREAS OR WITHIN 0.6m IF WITHIN LANDSCAPED AREAS, AN EXPANSION JOINT IS TO BE PROVIDED AT EACH AND EVERY PIPE JOINT.
8. ANY GRADIENTS OF DRAINS INDICATED ARE INDICATIVE ONLY AND THE CONTRACTOR SHALL INSTALL THE DRAINS TO THE SPECIFIED LEVELS SHOWN FOR EACH MANHOLE (U.O.N.). CATCHPIT INVERT LEVELS ARE FOR THE OUTGOING PIPE WITH THE SUMP LEVEL SPECIFIED SEPARATELY.
9. ALL PIPEWORK WITHIN MANHOLES ARE TO BE LAID SOFFIT TO SOFFIT (U.O.N.). ALL CHAMBER INVERT LEVELS ARE FOR THE OUTGOING PIPE LEVELS. BACKDROP PIPEWORK SHALL BE CONNECTED AT SOFFIT TO SOFFIT WITH THE RODDING ACCESS LEVEL SPECIFIED.
10. ALL INVERT LEVELS PROVIDED FOR 475mm PPIC CHAMBER ARE TO THE LOWEST PIPE WITHIN THE BENCHING ARRANGEMENT.
11. DRAINAGE CHANNELS ARE TO BE ACO MD SYSTEM C/W 'HEELGUARD' GRATES OR 'BRICKSLOT' TO LANDSCAPE ARCHITECT APPROVAL.

1. ALL LEVELS ARE IN METRES.
2. ALL DIMENSIONS ARE IN MILLIMETRES.
3. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE ACCURACY OF ALL DIMENSIONS AND LEVELS AND FOR THE CORRECT SETTING OUT OF THE WORK ON SITE UNLESS NOTED OTHERWISE.
4. THE CONTRACTOR SHALL ENSURE ALL NECESSARY PRECAUTIONS ARE TAKEN TO PROTECT EXISTING SERVICES DURING THE WORKS.

	PROPOSED FOUL WATER DRAINAGE
	PROPOSED SURFACE WATER DRAINAGE
	PROPOSED LAND DRAINAGE
	PROPOSED 1200Ø PCC
	PROPOSED 450Ø PPIC
	PROPOSED 300Ø MINI PPIC (MAX 600 DP)
RWP	RAINWATER PIPE
SVP	SOIL VENT PIPE
RE	RODDING EYE
	SITE BOUNDARY

ALL PIPEWORK TO BE
100Ø UNLESS NOTED
OTHERWISE

12. MANHOLE COVERS AND FRAMES ARE TO BE IN ACCORDANCE WITH BS EN 124 AND THE FOLLOWING:
 - VEHICULAR AREAS: CLASS D400 (€600 IN SERVICE YARD LOCATIONS)
 - DOUBLE TRIANGULAR, 150mm DEEP DUCTILE IRON COVER AND FRAME WITH THREE POINT COVER SEATING, (NON-ROCK DESIGN) BADGED FW OR SW FOR FOUL OR SURFACE WATER DRAINAGE.
 - PEDESTRIAN AREAS: CLASS B125, 100mm DEEP, BADGED FW OR SW FOR FOUL OR SURFACE WATER DRAINAGE.
 - IF COVERS ARE REQUIRED TO BE RECESSED A HOWE GREEN 1050 HEAVY DUTY, STAINLESS STEEL EDGE, EXTERNAL USE, 100mm RECESS OR SIMILAR APPROVED SHALL BE USED.
13. REFER TO ARCHITECT'S DRAWING FOR RWP'S/WPC'S POP UP SIZES. ALL REST BENDS ARE ASSUMED TO BE 1000SET 600mm BELOW SSL, UNLESS OTHER SPECIFIED. THE CONTRACTOR SHALL ALLOW FOR SUITABLE VIKING JOHNSON ADAPTORS/COUPLINGS FOR JOINTING THE DIFFERENT PIPE MATERIALS/PIPE SIZES.
14. ALL BRICKWORK IN CONNECTION WITH DRAINAGE IS BE SOLID ENGINEERING BRICK CLASS B TO BS 3921.
15. ALL IN SITU CONCRETE TO BE GEN3 UNLESS SPECIFIED OTHERWISE.
16. ALL PRECAST CONCRETE PIPES, CHAMBER PRODUCTS AND ROAD GULLIES SHALL BE TO BS 5911 AND BE KITEMARKED.
17. VITRIFIED CLAY PIPES TO CONFORM TO BS EN 295 MANUFACTURER: HEF WORTH SUPERSLEEVE;
 - 100/150mmØ -40 kN/m
 - 225mmØ -45 kN/m
 - 300mmØ -72 kN/mAND BE SUPPLIED WITH EPDM SEALING RINGS AS STANDARD.
18. PLASTIC PIPEWORK IS ACCEPTABLE AND SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE MANUFACTURERS' RECOMMENDATIONS.
19. UPON COMPLETION OF THE WORKS, ALL THE DRAINS SHALL BE CLEANED BY JETTING, REMOVING ALL DEBRIS FROM SITE. NO DEBRIS SHALL BE PERMITTED TO ENTER THE EXISTING DRAINAGE SYSTEM.
20. UPON COMPLETION OF THE WORKS THE CONTRACTOR SHALL SURVEY THE WORKS AND PROVIDE A SUITABLY 'MARKED-UP' DRAWINGS FOR 'RECORD' PURPOSES'.

A	01.03.24	PG	GWK	PRELIMINARY ISSUE
No	DATE	DRAWN	REV'D ENC.	AMENDMENT



CLIENT	RIDER ENTERPRISES			
PROJECT	SUGAR STREET, RUSHTON SPENCER			
DRAFTER	PG	ENGINEER	GWK	
TITLE	DRAINAGE GA			
SCALE	DRAWING No	DATE	AMDT	
1:200	GK4270-C-001	01.03.24	A	

Appendix B - GWK Drainage Calculations



Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	5	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.300	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
SW MH01	0.019	4.00	164.850	450	0.700
SW MH02			164.850	450	1.050
SW MH03	0.022	4.00	164.850	450	0.700
SW MH04			164.850	450	1.130
SW MH05	0.060	4.00	165.980	450	1.150
SW MH06	0.008	4.00	165.950	450	2.355
SW MH07			166.200	1200	2.725
TANK			166.200	100	2.755
PUMP STATION			166.200	1200	2.785

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	SW MH01	SW MH02	42.000	0.600	164.150	163.800	0.350	120.0	150	4.76	50.0
1.001	SW MH02	SW MH04	10.000	0.600	163.800	163.720	0.080	125.0	150	4.95	50.0
2.000	SW MH03	SW MH04	42.000	0.600	164.150	163.720	0.430	97.7	150	4.69	50.0
1.002	SW MH04	SW MH06	7.000	0.600	163.720	163.670	0.050	140.0	150	5.09	50.0
3.000	SW MH05	SW MH06	10.000	0.600	164.830	164.670	0.160	62.5	150	4.13	50.0
1.003	SW MH06	SW MH07	13.000	0.600	163.595	163.475	0.120	108.3	225	5.26	50.0
1.004	SW MH07	TANK	2.000	0.600	163.475	163.445	0.030	66.7	225	5.28	50.0
1.005	TANK	PUMP STATION	2.000	0.600	163.445	163.415	0.030	66.7	150	5.31	50.0

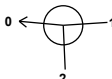
Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
1.000	0.916	16.2	2.6	0.550	0.900	0.019	0.0
1.001	0.897	15.9	2.6	0.900	0.980	0.019	0.0
2.000	1.017	18.0	3.0	0.550	0.980	0.022	0.0
1.002	0.847	15.0	5.6	0.980	2.130	0.041	0.0
3.000	1.274	22.5	8.1	1.000	1.130	0.060	0.0
1.003	1.255	49.9	14.8	2.130	2.500	0.109	0.0
1.004	1.604	63.8	14.8	2.500	2.530	0.109	0.0
1.005	1.233	21.8	14.8	2.605	2.635	0.109	0.0

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	42.000	120.0	150	Circular	164.850	164.150	0.550	164.850	163.800	0.900
1.001	10.000	125.0	150	Circular	164.850	163.800	0.900	164.850	163.720	0.980
2.000	42.000	97.7	150	Circular	164.850	164.150	0.550	164.850	163.720	0.980
1.002	7.000	140.0	150	Circular	164.850	163.720	0.980	165.950	163.670	2.130
3.000	10.000	62.5	150	Circular	165.980	164.830	1.000	165.950	164.670	1.130
1.003	13.000	108.3	225	Circular	165.950	163.595	2.130	166.200	163.475	2.500
1.004	2.000	66.7	225	Circular	166.200	163.475	2.500	166.200	163.445	2.530
1.005	2.000	66.7	150	Circular	166.200	163.445	2.605	166.200	163.415	2.635

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	SW MH01	450	Manhole	Adoptable	SW MH02	450	Manhole	Adoptable
1.001	SW MH02	450	Manhole	Adoptable	SW MH04	450	Manhole	Adoptable
2.000	SW MH03	450	Manhole	Adoptable	SW MH04	450	Manhole	Adoptable
1.002	SW MH04	450	Manhole	Adoptable	SW MH06	450	Manhole	Adoptable
3.000	SW MH05	450	Manhole	Adoptable	SW MH06	450	Manhole	Adoptable
1.003	SW MH06	450	Manhole	Adoptable	SW MH07	1200	Manhole	Adoptable
1.004	SW MH07	1200	Manhole	Adoptable	TANK	100	Manhole	Adoptable
1.005	TANK	100	Manhole	Adoptable	PUMP STATION	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SW MH01	77.130	29.492	164.850	0.700	450				
						0	1.000	164.150	150
SW MH02	39.503	25.763	164.850	1.050	450				
						0	1.001	163.800	150
SW MH03	77.638	47.458	164.850	0.700	450				
						0	2.000	164.150	150
SW MH04	38.655	44.915	164.850	1.130	450				
						1	2.000	163.720	150
						2	1.001	163.720	150
						0	1.002	163.720	150
SW MH05	23.232	68.305	165.980	1.150	450				
						0	3.000	164.830	150
SW MH06	14.418	47.119	165.950	2.355	450				
						1	3.000	164.670	150
						2	1.002	163.670	150
						0	1.003	163.595	225
SW MH07	-4.904	43.390	166.200	2.725	1200				
						1	1.003	163.475	225
						0	1.004	163.475	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
TANK	-3.548	31.186	166.200	2.755	100	1 	1.004	163.445	225
PUMP STATION	-5.073	3.220	166.200	2.785	1200	0 	1.005	163.445	150
						1	1.005	163.415	150

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.300	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	40	0	0
100	45	0	0

Node PUMP STATION Online Pump Control

Flap Valve	x	Design Depth (m)	1.000	Switch off depth (m)	0.300
Replaces Downstream Link	✓	Design Flow (l/s)	4.0		
Invert Level (m)	163.415	Switch on depth (m)	0.500		

Depth (m)	Flow (l/s)
1.000	4.000

Node TANK Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	163.445
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	176

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	40.0	0.0	1.200	40.0	0.0	1.201	0.0	0.0

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year 15 minute summer	99.562	28.172	30 year +40% CC 360 minute summer	49.250	12.674
1 year 15 minute winter	69.868	28.172	30 year +40% CC 360 minute winter	32.014	12.674
1 year 30 minute summer	67.776	19.178	30 year +40% CC 480 minute summer	39.088	10.330
1 year 30 minute winter	47.562	19.178	30 year +40% CC 480 minute winter	25.969	10.330
1 year 60 minute summer	48.435	12.800	30 year +40% CC 600 minute summer	32.201	8.808
1 year 60 minute winter	32.179	12.800	30 year +40% CC 600 minute winter	22.002	8.808
1 year 120 minute summer	31.831	8.412	30 year +40% CC 720 minute summer	28.837	7.729
1 year 120 minute winter	21.148	8.412	30 year +40% CC 720 minute winter	19.380	7.729
1 year 180 minute summer	25.499	6.562	30 year +40% CC 960 minute summer	23.860	6.283
1 year 180 minute winter	16.575	6.562	30 year +40% CC 960 minute winter	15.805	6.283
1 year 240 minute summer	20.693	5.468	30 year +40% CC 1440 minute summer	17.478	4.684
1 year 240 minute winter	13.748	5.468	30 year +40% CC 1440 minute winter	11.747	4.684
1 year 360 minute summer	16.369	4.212	100 year +45% CC 15 minute summer	457.253	129.387
1 year 360 minute winter	10.640	4.212	100 year +45% CC 15 minute winter	320.879	129.387
1 year 480 minute summer	13.246	3.501	100 year +45% CC 30 minute summer	315.333	89.228
1 year 480 minute winter	8.801	3.501	100 year +45% CC 30 minute winter	221.286	89.228
1 year 600 minute summer	11.089	3.033	100 year +45% CC 60 minute summer	222.268	58.739
1 year 600 minute winter	7.577	3.033	100 year +45% CC 60 minute winter	147.669	58.739
1 year 720 minute summer	10.069	2.699	100 year +45% CC 120 minute summer	140.640	37.167
1 year 720 minute winter	6.767	2.699	100 year +45% CC 120 minute winter	93.438	37.167
1 year 960 minute summer	8.526	2.245	100 year +45% CC 180 minute summer	108.352	27.883
1 year 960 minute winter	5.648	2.245	100 year +45% CC 180 minute winter	70.431	27.883
1 year 1440 minute summer	6.448	1.728	100 year +45% CC 240 minute summer	85.732	22.657
1 year 1440 minute winter	4.334	1.728	100 year +45% CC 240 minute winter	56.959	22.657
30 year +40% CC 15 minute summer	341.346	96.589	100 year +45% CC 360 minute summer	65.640	16.891
30 year +40% CC 15 minute winter	239.541	96.589	100 year +45% CC 360 minute winter	42.668	16.891
30 year +40% CC 30 minute summer	232.942	65.915	100 year +45% CC 480 minute summer	51.792	13.687
30 year +40% CC 30 minute winter	163.468	65.915	100 year +45% CC 480 minute winter	34.409	13.687
30 year +40% CC 60 minute summer	163.225	43.136	100 year +45% CC 600 minute summer	42.461	11.614
30 year +40% CC 60 minute winter	108.443	43.136	100 year +45% CC 600 minute winter	29.012	11.614
30 year +40% CC 120 minute summer	103.463	27.342	100 year +45% CC 720 minute summer	37.866	10.149
30 year +40% CC 120 minute winter	68.738	27.342	100 year +45% CC 720 minute winter	25.448	10.149
30 year +40% CC 180 minute summer	80.238	20.648	100 year +45% CC 960 minute summer	31.114	8.193
30 year +40% CC 180 minute winter	52.157	20.648	100 year +45% CC 960 minute winter	20.610	8.193
30 year +40% CC 240 minute summer	63.838	16.870	100 year +45% CC 1440 minute summer	22.552	6.044
30 year +40% CC 240 minute winter	42.412	16.870	100 year +45% CC 1440 minute winter	15.157	6.044

Results for 1 year Critical Storm Duration. Lowest mass balance: 97.47%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SW MH01	10	164.191	0.041	2.6	0.0289	0.0000	OK
720 minute winter	SW MH02	450	163.916	0.116	0.3	0.0185	0.0000	OK
15 minute winter	SW MH03	10	164.191	0.041	3.0	0.0325	0.0000	OK
480 minute winter	SW MH04	344	163.916	0.196	0.9	0.0312	0.0000	SURCHARGED
15 minute summer	SW MH05	10	164.896	0.066	8.1	0.0796	0.0000	OK
480 minute winter	SW MH06	344	163.916	0.321	2.3	0.0728	0.0000	SURCHARGED
480 minute winter	SW MH07	344	163.916	0.441	2.2	0.4990	0.0000	SURCHARGED
480 minute winter	TANK	344	163.915	0.470	3.3	18.8039	0.0000	SURCHARGED
360 minute winter	PUMP STATION	320	163.915	0.500	1.9	0.5651	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	SW MH01	1.000	SW MH02	2.6	0.686	0.161	0.1596	
720 minute winter	SW MH02	1.001	SW MH04	0.7	0.264	0.046	0.1614	
15 minute winter	SW MH03	2.000	SW MH04	3.0	0.575	0.165	0.2323	
480 minute winter	SW MH04	1.002	SW MH06	0.9	0.446	0.060	0.1232	
15 minute summer	SW MH05	3.000	SW MH06	8.1	1.128	0.360	0.0718	
480 minute winter	SW MH06	1.003	SW MH07	2.2	0.402	0.043	0.5170	
480 minute winter	SW MH07	1.004	TANK	3.3	0.636	0.052	0.0795	
480 minute winter	TANK	1.005	PUMP STATION	1.9	0.119	0.088	0.0352	
360 minute winter	PUMP STATION	Pump		1.9				10.6

Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 97.47%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	SW MH01	172	164.308	0.158	1.9	0.1111	0.0000	SURCHARGED
240 minute winter	SW MH02	172	164.308	0.508	1.9	0.0807	0.0000	SURCHARGED
240 minute winter	SW MH03	172	164.308	0.158	2.2	0.1247	0.0000	SURCHARGED
240 minute winter	SW MH04	172	164.308	0.588	3.7	0.0934	0.0000	SURCHARGED
15 minute winter	SW MH05	10	165.127	0.297	27.9	0.3573	0.0000	SURCHARGED
240 minute winter	SW MH06	172	164.307	0.712	10.0	0.1617	0.0000	SURCHARGED
240 minute winter	SW MH07	172	164.306	0.831	9.8	0.9398	0.0000	SURCHARGED
240 minute winter	TANK	172	164.306	0.861	9.6	34.4508	0.0000	SURCHARGED
240 minute winter	PUMP STATION	172	164.304	0.889	3.6	1.0057	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
240 minute winter	SW MH01	1.000	SW MH02	1.9	0.560	0.117	0.7394	
240 minute winter	SW MH02	1.001	SW MH04	1.5	0.384	0.093	0.1760	
240 minute winter	SW MH03	2.000	SW MH04	2.2	0.447	0.122	0.7394	
240 minute winter	SW MH04	1.002	SW MH06	3.3	0.568	0.217	0.1232	
15 minute winter	SW MH05	3.000	SW MH06	27.7	1.575	1.231	0.1741	
240 minute winter	SW MH06	1.003	SW MH07	9.8	0.615	0.196	0.5170	
240 minute winter	SW MH07	1.004	TANK	9.6	0.895	0.150	0.0795	
240 minute winter	TANK	1.005	PUMP STATION	3.6	0.210	0.164	0.0352	
240 minute winter	PUMP STATION	Pump		3.6				49.5

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 97.47%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	SW MH01	180	164.619	0.469	2.5	0.3295	0.0000	FLOOD RISK
240 minute winter	SW MH02	180	164.619	0.819	2.5	0.1302	0.0000	FLOOD RISK
240 minute winter	SW MH03	180	164.619	0.469	2.9	0.3699	0.0000	FLOOD RISK
240 minute winter	SW MH04	180	164.619	0.898	4.7	0.1429	0.0000	FLOOD RISK
15 minute winter	SW MH05	10	165.371	0.541	37.4	0.6513	0.0000	SURCHARGED
240 minute winter	SW MH06	180	164.618	1.023	13.3	0.2322	0.0000	SURCHARGED
240 minute winter	SW MH07	180	164.617	1.142	13.0	1.2916	0.0000	SURCHARGED
240 minute winter	TANK	180	164.616	1.171	12.8	46.8663	0.0000	SURCHARGED
240 minute winter	PUMP STATION	180	164.614	1.199	4.2	1.3561	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
240 minute winter	SW MH01	1.000	SW MH02	2.5	0.560	0.154	0.7394	
240 minute winter	SW MH02	1.001	SW MH04	2.1	0.372	0.131	0.1760	
240 minute winter	SW MH03	2.000	SW MH04	2.8	0.438	0.155	0.7394	
240 minute winter	SW MH04	1.002	SW MH06	4.4	0.560	0.297	0.1232	
15 minute winter	SW MH05	3.000	SW MH06	36.9	2.097	1.640	0.1743	
240 minute winter	SW MH06	1.003	SW MH07	13.0	0.645	0.261	0.5170	
240 minute winter	SW MH07	1.004	TANK	12.8	0.970	0.201	0.0795	
240 minute winter	TANK	1.005	PUMP STATION	4.2	0.370	0.192	0.0352	
240 minute winter	PUMP STATION	Pump		4.0				68.6